Schick describes that the anti-aliasing filter 182 is *necessary*:

> First, although S_{IF} (t) (output of mixer 168) represents a down-converted and band-limited subset of S_{RF} (t) (within composite signal 120), it still contains high frequency components which would alias when digitally sampled by the Analog-to-Digital Converter (ADC) 192. This simply means that frequency components higher than half the sampling frequency appear as low frequency artifacts in a Fast Fourier Transform (FFT) spectrum, thereby interfering with genuine low frequency component measurements. The *IF BPF bank 182 thus primarily operates as an anti-aliasing filter*, but also serves to attenuate unwanted low frequency mixing products as well as video and audio modulation signals. (Emphasis added). Col. 8, lines 49-61.

Thus, Schick is just like the configurations described in the background of the instant application that the inventors recognized could be improved by eliminating the need for such anti-aliasing filters.

Contrary to the Examiner's interpretation of the claims, that inventive approach recited in each of the independent claims is not just the well known Nyquist sampling theorem to sample at a frequency more than twice the highest frequency of the highest frequency component of the desired signal being sampled. The Examiner is encouraged to review the background and summary section of the instant application for a detailed explanation.

No where do Schick or Hoenninger disclose or suggest "a frequency of the *local oscillator signal* is *set in relation to a frequency of a sampling rate* of the analog-to-digital converter *to avoid aliasing in a desired receive band*." The Examiner alleges that Schick discloses this feature, but Applicants find no such teaching.

The Examiner makes reference to col. 6, lines 52-67 in Schick. These lines merely state the Nyquist theorem that "in order to preserve all frequency information when digitizing a continuous-time signal, the minimum sampling rate should be at least twice that of the highest

frequency component of the signal being sampled." But this text relates to the sampling rate of the ADC 192. It does not describe relating the local oscillator frequency to the frequency of a sampling rate of the analog-to-digital converter to avoid aliasing in a desired receive band.

The Examiner also refers to col. 10, lines 1-26 in Schick. This text describes synchronizing the sampling operation. Schick explains at col. 9, lines 20-33:

> The ADC 192 samples its input at a rate determined by signal S_{FS} (t) provided by signal generator 194 which is phase-locked to the 1.024 MHz system reference 108 applied thereto via signal path 110. Even so, data sampling can begin at any point relative to the IF signal components to be analyzed...It is therefore necessary to include some form of time synchronization signal, S_{SYNC} (t), such as that provided by signal generator 196, which is also phase-locked to the 1.024 MHz system reference 108 applied thereto via signal path 110.

Thus, the aliasing referred to in column 10 relates to the time synchronization signal, S_{SYNC} (t), which operates on the <u>already-filtered</u> IF signal at summer 190. The time synchronization signal, S_{SYNC} (t), is not the local oscillator's 170 output signal and is not used to prevent aliasing caused by the mixing operation at mixer 168.

Thus, neither portion of Schick relied on by the Examiner teaches the claimed relationship between the local oscillator 170 frequency and the ADC 192 sampling frequency. Nor does the Examiner explain how Hoenninger teaches this claimed relationship. The dependent claim features of "the frequency of the local oscillator signal is an integer multiple of half of the sampling rate of the analog-to-digital converter" or " the frequency of the local oscillator signal F_{LO} is $F_{LO} = n * F_{ADC} / 2$, where F_{ADC} is the sampling rate of the analog-to-digital converter, and n is a positive integer" are also missing from both Schick and Hoenninger. Contrary to the Examiner's position, these two quoted claim features are <u>not</u> the same as the

Nyquist sampling theorem. Again, the claim language is directed to "the frequency of the local oscillator signal" and ***not*** to the received signal being sampled.

Additional features of the independent claims are missing from the prior art combination applied by the Examiner. The Examiner admits that Schick fails to disclose "a receiver without a filter between the mixer and the analog-to-digital converter," but contends that Schick discloses that the filter 182 is an "option." Applicants respectfully disagree. The text cited by the Examiner at col. 8, line 58-col. 9, line 19 does not support the Examiner's contention. To the contrary, the term filter and attenuation are used repeatedly. Indeed, Schick states that the anti-aliasing filtering is required: "The present invention may use a 12-bit ADC 192, thus requiring 78 dB (from full-scale input level) of stop-band attenuation at potential alias frequencies to satisfy the stated criteria." Col. 9, lines 8-11. At best, Schick simply suggests the option of filtering using a bandpass filtering bank 182 or a single wide-band LPF to "eliminate alias frequencies." Col. 9, lines 12-15. But there is no question that Schick requires some sort of anti-aliasing filter.

Nor does Hoenninger teach directly coupling an LO mixer to an ADC without an anti-aliasing filter as the Examiner contends. Hoenninger describes a digital lowpass filter design for filtering nuclear magnetic resonance (NMR) signals in a magnetic resonance imaging (MRI) system. The Examiner points to block 156 coupled to ADC block 166 in Figure 2. But the Examiner ignores the description in Hoenninger regarding those two blocks which explicitly requires that an anti-aliasing filter:

> During receive operation, T/R switch 64 couples RF coil 66 to analog signal processing circuitry 156 including for example a conventional RF amplifier, first intermediate frequency (IF) stage (including **an anti-aliasing bandpass analog filter**) and associated mixer, and second IF stage (including **an analog**

> **bandpass filter for anti-aliasing** and out-of-band signal rejection and associated mixer. In this example, local oscillator signals (e.g., "Rx Freq") applied to the first and second mixers are derived by a frequencer [sic] synthesizer 158 and an appropriate frequency divider 160, respectively, from a master time base 162.

So, combining Hoenninger with Schick, even if it were possible, would require an anti-aliasing filter between the LO mixer and the ADC, contrary to the recitation in claims 1, 24, and 30. Nor does the combination teach that an "analog, frequency-converted signal is connected directly to an input of the analog-to-digital converter" as recited in claim 17.

The Federal Circuit has consistently held that there must be "some teaching, suggestion, or motivation to combine references." *In re Rouffet*, 149 F.3d 1350, 1355 (Fed. Cir. 1998). "Stated another way, the prior art as a whole must 'suggest the desirability' of the combination." *In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004). Just because something is feasible does not make it desirable. The Federal Circuit mandates that "motivation to combine requires the latter [desirable]." *Winner Int'l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 (Fed. Cir. 2000). At best the Examiner is speculating that what is claimed is feasibile.

In addition, the Federal Circuit *requires* consideration of the problem confronted by the inventor in determining whether it would have been obvious to combine references in order to solve that problem. *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 935 (Fed. Cir. 1990). Indeed, the Examiner must show reasons why one of ordinary skill in the art, confronted with the same problem as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed. See *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998).

The *Rouffet* Court warned against "rejecting patents solely by finding prior art corollaries for the claimed elements" because that would "permit an Examiner to use the claimed invention

itself as a blueprint for piecing together elements in the prior art." *In re Rouffet*, 149 F.3d at 1357. That approach was found by the Federal Circuit to be "an illogical and inappropriate process by which to determine patentability." *Sensonics v. Aerosonic Corp.*, 85 F.3d 1566, 1570 (Fed. Cir. 1996).

Neither reference addresses the problem of preventing anti-aliasing without using an anti-aliasing filter. Schick clearly shows an anti-aliasing filter 182 between mixer 168 and the ADC 192. As is made clear by Schick in the text quoted above, the anti-aliasing filter 182 is required; otherwise, undesired aliasing occurs. Hoenninger similarly requires anti-aliasing filters. No where does Schick or Hoenninger disclose setting the *local oscillator* frequency in relation to the frequency of a sampling rate of the analog-to-digital converter to avoid aliasing in a desired receive band.

The obviousness rejection is improper for several reasons and should be withdrawn. The application is now in condition for allowance. An early notice to that effect is earnestly solicited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: ______________________
John R. Lastova
Reg. No. 33,149

JRL:maa
901 North Glebe Road, 11th Floor
Arlington, VA 22203-1808
Telephone: (703) 816-4000
Facsimile: (703) 816-4100